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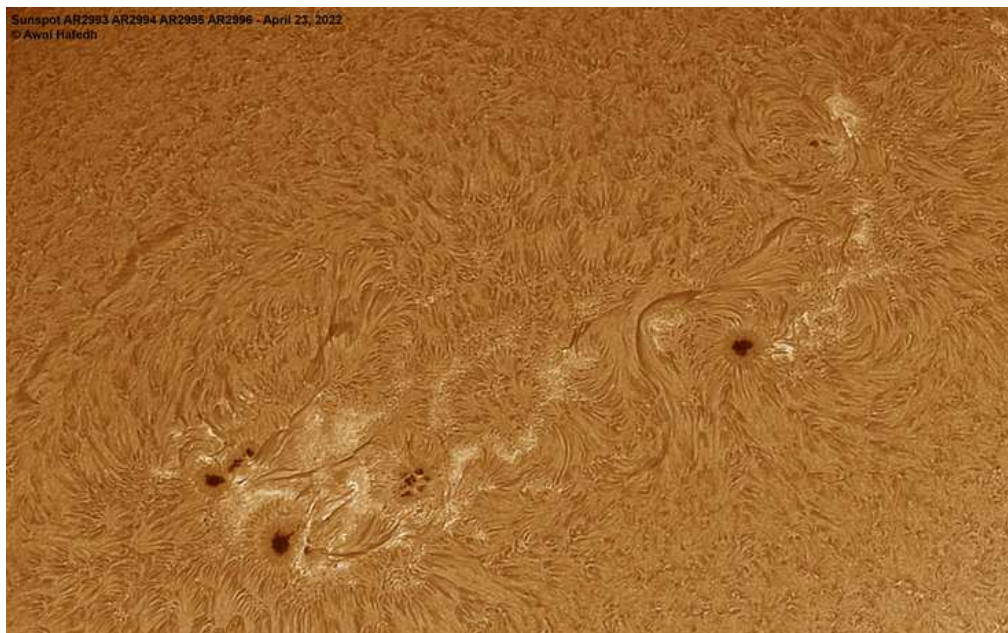
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## SUNSPOTS AR2993, AR2994, AR2995, and AR2996

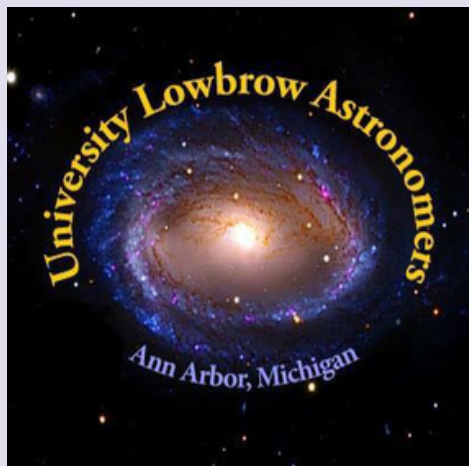
BY AWNI HAFEDH

I don't remember the last time I saw so many sunspots in such a tight field of view. I've been seeing a lot of images of sunspots lately and am happy I got a chance to capture them. I also captured a lot of videos and it'll take me some time to create a timelapse.

This photo is a single from a 4000-frame video, stacked 20% in AutoStakkert3. Sharpening and color were done using Astrosurface-R3, PixInsight, Luminar4, and Photoshop. A very tiny amount of sharpening, smoothing, and noise reduction was done to preserve the image's natural look without overprocessing it.

As usual, my setup is:  
Lunt60THa with custom auto focuser  
and pressure tuner telescope  
Televue 5x barlow  
ZWO ASI174MM Camera  
iOptron CEM25P Mount ■

See also Doug Bock's photo of sunspots from April 21, p. 6



# THE SUMMER TRIANGLE - IT'S BACK! (AT 2:30 AM)

BY ADRIAN BRADLEY

The Summer Triangle rises at around 2:30am. The rise time will continue to push further and further back each night until close to summer, when it rises during astronomical twilight. In the fall, this section of the Milky Way is high overhead at astronomical twilight, and switches places with the Orion side of the Milky Way, which then rises at the 2:30/3 am hour.

For many who like to shoot the 'core' of the Milky Way as a part of their nightscapes, this heralds the beginning of the 'Milky Way Season' in the Northern Hemisphere. But I have always felt that our so-called 'Milky Way Season' is actually a year-round thing. At our ~42 degree latitude, it ends up on the horizon.

Watch for Cassiopeia to start traveling to the northeast side. It's shaped like a 'W' on the horizon. The Milky Way goes right through Cassiopeia. Also, you'll notice a bright star, Vega, rising to the east. When Deneb rises above the horizon, then the bright 'Cygnus region (pictured in this

photo at the left side of the Milky Way) rises with it. Also, you will see the Scorpius constellation (not pictured here) rise to the southeast with the bright red giant star Antares. These are up early in the morning before sunrise. They are your indicators that the galactic core is an hour or so from making an appearance. As the galactic core rises, Aquilla the Eagle breaks the horizon with its bright three stars Alshain, Altair, and Tarazed all in a line. Binocular astronomers can start looking for Saggita the Arrow, and CR 399 the Coathanger cluster. Both are visible in the image above.

This month, visual planet hunters will want to wait until Saggitarius rises below the galactic center because the lineup of planets will come after it. Dwarf planet Pluto is closest to the galactic center, followed by Saturn, Mars, Jupiter, Neptune, and Venus.

This is a great time to be up early in the morning before sunrise, whether you image the sky or observe it visually! ■





# THE MAY 16 LUNAR ECLIPSE

BY JIM FORRESTER

Though the May 15/16 Lunar Eclipse will peak just past midnight early the 16th, observers willing to accept a short night's sleep will be rewarded with a long, red-orange totality. The moon will be nearing perigee, so at 33' it will look a bit larger than usual in our sky.

Observing the eclipse will require a good southeastern horizon. Norbert Vance will be opening the Sherzer Observatory on the Eastern Michigan University campus for observing the event. Masks will be required in the building and inside the observatory dome.

Some Lowbrows are considering setting up at the south end of Leslie Park on Ann Arbor's north side. Wherever you think of going, check the horizons in advance. The moon will be only 15.5 degrees above the horizon at 10:27 PM when the umbral eclipse begins. If you're observing from a dark site, you could see the rising summer Milky Way pop out during totality.

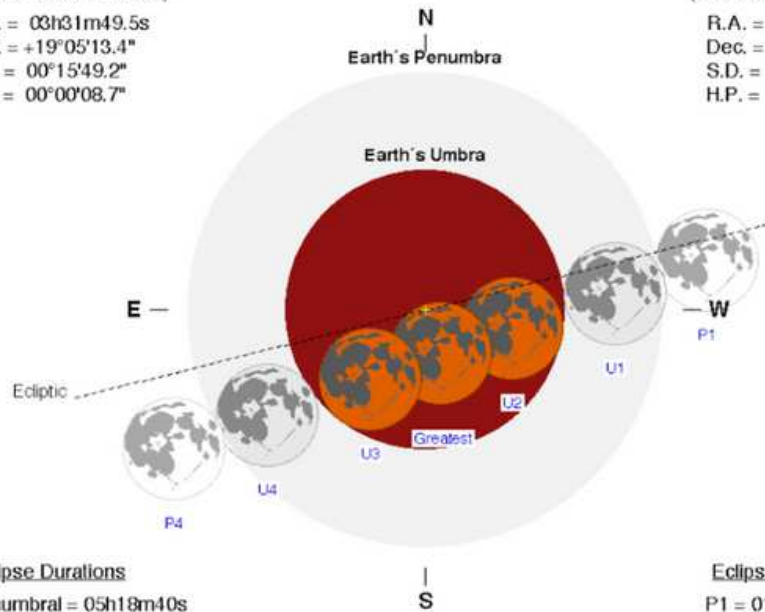
At right is all the rest you'll need to know. courtesy of Fred Espanak and NASA. ■

## Total Lunar Eclipse of 2022 May 16

Ecliptic Conjunction = 04:15:18.8 TD (= 04:14:06.0 UT)  
 Greatest Eclipse = 04:12:41.6 TD (= 04:11:28.8 UT)  
 Penumbral Magnitude = 2.3726    P. Radius = 1.2854°    Gamma = -0.2532  
 Umbral Magnitude = 1.4137    U. Radius = 0.7580°    Axis = 0.2555°  
 Saros Series = 131    Member = 34 of 72

Sun at Greatest Eclipse  
 (Geocentric Coordinates)  
 R.A. = 03h31m49.5s  
 Dec. = +19°05'13.4"  
 S.D. = 00°15'49.2"  
 H.P. = 00°00'08.7"

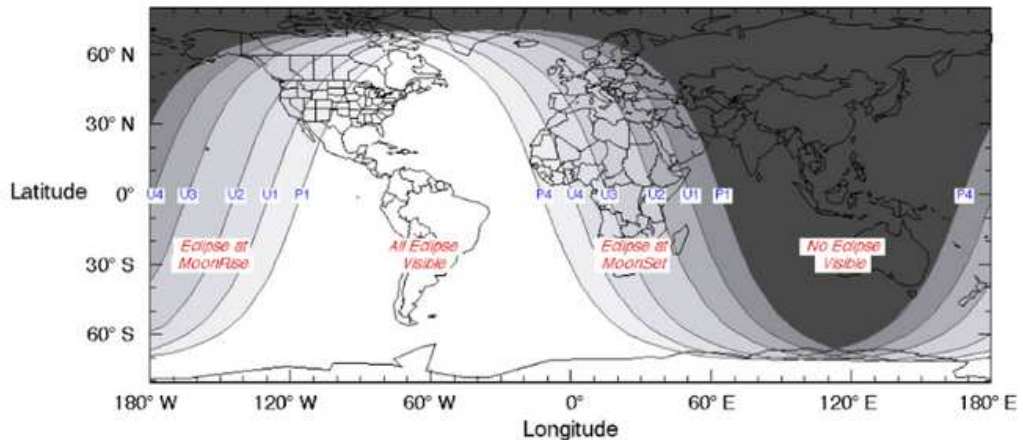
Moon at Greatest Eclipse  
 (Geocentric Coordinates)  
 R.A. = 15h31m27.8s  
 Dec. = -19°19'40.4"  
 S.D. = 00°16'29.9"  
 H.P. = 01°00'33.1"



Eclipse Durations  
 Penumbral = 05h18m40s  
 Umbral = 03h27m14s  
 Total = 01h24m53s  
 ΔT = 73 s  
 Rule = CdT (Danjon)  
 Eph. = VSOP87/ELP2000-85

Eclipse Contacts  
 P1 = 01:32:07 UT  
 U1 = 02:27:53 UT  
 U2 = 03:29:03 UT  
 U3 = 04:53:56 UT  
 U4 = 05:55:07 UT  
 P4 = 06:50:48 UT

0 15 30 45 60  
 Arc-Minutes  
 F. Espanak, NASA's GSFC  
[eclipse.gsfc.nasa.gov/eclipse.html](http://eclipse.gsfc.nasa.gov/eclipse.html)



2009 Apr 29

# 3D Printed Astro Clock Design Phase 2

BY CHUCK STEELE

This winter during cold and cloudy nights, I worked on my 3D printed clock. I wanted to add a moving star chart to the original design with a horizon line to show which stars are visible. My first design was to add a separate enclosure to house the star chart. But while working on the clock, and fixing some mechanical issues, it occurred to me that I could add the star chart to the face of the clock. As my clock has a 24-hour hand on it, I could easily add the horizon line to the hour hand. Happily, the horizon line needs to travel in a clockwise direction so this worked very well.

Second, the star chart would have to be geared to rotate once every 365 days in a counter-clockwise direction. Some quick math showed me that 5 divides into 365 evenly. (Not going to worry about the extra quarter day as I can easily reset the star chart every 4 years.) I also discovered that one of the gears that drive the lunar phase rotates once every 5 days. So all I had to do is transfer this rotation motion to the point where I can drive the star chart gear. Five goes into 365 73 times, so I decided I would use a ratch ring gear with a paw. Moving the Star chart once every 5 days would lead to rather a jerky movement, so I decided to double the teeth to 146 teeth with 2 paws per rotation. The star chart advances every 2.5 days; not perfect, but good enough for this project.



**ABOVE: Clock gear assembly. The saw tooth ring gear is held in place with curved guide plates. At the bottom of the ring gear is 2-bladed paw gear which rotates every 5 days advancing the star chart 2 times. The Moon globe is stationary showing the same face to the viewer with a separate cover to display the moon phases.**



**ABOVE: This photo shows the star chart attached to the ring gear. Chart was drawn using Corel Draw.**

The clock features a 24-hour dial with 12 noon at the top and midnight or zero hour at the bottom. On the hour hand is a sun which points out the hours. I have my clock mounted on a south-facing wall, so as the sun is rising in the east the hour hand sun is pointing to the east. As the Sun rises to noon, the hour hand sun follows the same direction to the zenith. As the sun sets in the west, the hour hand is again pointing west.

As the sun sets, the sun on the dial goes to the bottom of the dial, and the horizon line showing the stars rises to the top of the dial just as the stars are appearing in the night sky.

The horizon line has the 4 points of the compass marked on it, N, E, S, & W. Also in between are tick

3D printed Astro Clock continues, p. 5.



3D printed Astro Clock continued from p. 4 ...

marks to show the NE, SE, SW & NW points. The inner circle outlines stars above 45 degrees. The meridian is indicated by the straight line running north to the zenith, then to the south. A curved line running from east to zenith to west bisects the night hemisphere in the other direction. Due to the polar projection of the night sky, this is a curved line, not a straight line. The approximate sidereal time can be read on the star chart at the south point on the horizon line. I made the star chart using Corel Draw software and using The Cambridge Star Atlas as a reference.

The clock uses a clock pendulum with a recoil crown gear. It has been quite a challenge to get this clock to run as they tend to be very sensitive to a number of factors: Friction is the enemy of grandfather clock movements, but it's running great now.

As a personal note, I spent last year dealing with cancer and moving into a new home out in the country away from city lights. I had a 95% positive response to the cancer treatment so I'm doing much better now. I wasn't up to observing with the telescope last year but I'll be getting the scope out soon as it warms up. I have a site free of trees and lights - much darker than Canton.

OK, one last challenge for you! Can you spot a mistake in one of the photos? Hint: Compare two of the photos. One is correct and one is not. Which is the correct one? Email me if you find it. It has since been corrected. ■



ABOVE: Detail view of star chart dial. The red circle is the ecliptic with dates of where the sun is each year. Of course, this varies slightly from year to year, but it gives a good indication of sun rise and sun set times.



ABOVE: Assembled Astro Star Clock hanging on the wall with new star chart and signs of the zodiac around the moon.

## UPCOMING MEETING SPEAKER SCHEDULE

**MAY 20:** Professor Rudi Lindner, U-M History. Topic: *The Michigan-California Axis in Astronomy*

**JUNE 17:** Dr. Zachary A. Constan, MSU. Topic: *"(almost) 14 Billion Years of Nuclei"*

**JULY 15:** TBA

**AUGUST 19:** Professor Karim Jaffer, John Abbott College. Topic: **Pending**

**SEPTEMBER 16:** TBA

**OCTOBER 21:** Associate Professor Elena Gallo, U of M Dept of Astronomy. Topic: *Seeing and Hearing Black Holes, (big and small)*

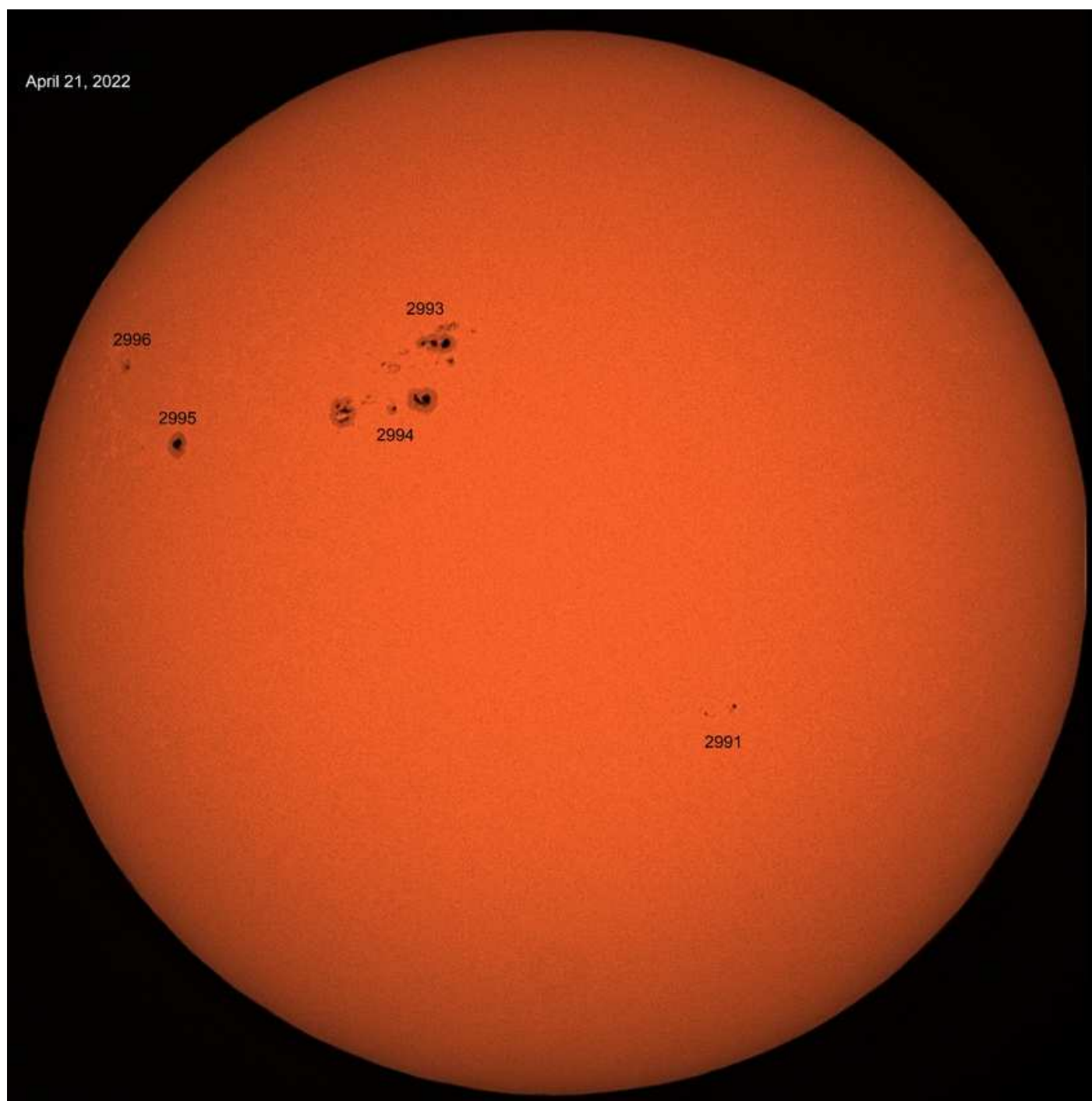
**NOVEMBER 18:** TBA

(Wikimedia Commons)

# SUNSPOTS AR2991, AR2993, AR2994, AR2995, and AR2996

BY DOUG BOCK

This was taken with my Celestron 6" SCT and the ZWO asi2600mc pro camera. This is a single frame from a 30-second video I captured using AutoStakkart3's analysis tool. I pulled just the best image of the 120 I collected. The sun has been very active this year as it heads into maximum. ■



# THE OBJECTIVE LENS - A MONTHLY ROLL OF IMAGES BY LOWBROW MEMBERS

As promised in the April issue, we're launching a new supplement to Reflections: The Objective Lens -- a monthly series of images submitted by Lowbrow members based on a theme. Thanks to everyone who sent in photos for this month's theme - "Galaxies." It was a great turnout!

We will email The Objective Lens as a separate pdf attachment on the seventh of each month along with Reflections. Why a separate pdf, you might ask? We wanted a super simple layout that could easily accommodate any number of submissions without raising the printing and mailing cost of the newsletter. We also wanted to avoid the formatting issues associated with printing black and white copies. Just think of The Objective Lens as the glossy supplement you used to find inserted in your Sunday newspaper.

A couple of reminders: Submissions to The Objective Lens will appear in our annual compilation titled Backfocus. Also, this is not a contest. We want your photos -- all kinds of them -- candid and otherwise. Are you just getting started with astrophotography? Wonderful. Already a Pro? Great! ALL photos are welcome. Next month: Show us your gear.

## UPCOMING THEMES:

**June** - Telescopes, binoculars, observatories, mounts, and observers observing (or preparing to as is more likely)!

**July** - The Milky Way (widefield, dark nebulae, nightscapes, reflected images, constellations within ... the whole ball of interstellar wax). ■

## COVID Policy for members-only events (and as a test for public events):

- 1) Proof of vaccination is required. Be prepared to show your vaccination card upon arrival. We will strictly enforce this for the safety, and respect, of others.
- 2) Masking is required. If a participant wishes not to mask due to glasses fogging (for example), they may unmask if someone is not within 6 feet, and/or that person and the other mutually agree. Due to the semi-indoor environment, masking is required in the observatory building.
- 3) Social distancing (min 6 ft) is to be maintained. Telescopes will be spaced such that a group of people at one scope do not violate the distancing of another group. ■

# THE GREAT GLOBULAR CLUSTER IN HERCULES, M13

BY DONOVAN DREW



The cluster is about 22 thousand light years away and comprised of about 700,000 stars.

## Brian Ottum @ AADL Wednesday, June 1

Come and check out Brian's public EAA program at 265 Parkland Plaza.

For more information: <https://aadl.org/node/584554>





# Lowbrow General Meeting

G115 Angell Hall, UM Central Campus

Zoom: <https://umich.zoom.us/j/96335537161>

April 15, 2022 7:30pm

**Come to Order:** 7:36pm

**Speaker:** Adrian Bradley - Book: Pte. Aux Barques Lighthouse Park Nightscapes

## Meeting Discussion:

1. GLAAC is considering vendor sales opportunities at AATB'22
2. Nominated & Elected:
  - a. President: Charlie Nielsen
  - b. VP:
    - i. Adrian Bradley
    - ii. Jim Forrester
    - iii. Brian Ottum
    - iv. Dave Snyder
  - c. Treasurer: Doug Scobel
  - d. Observatory Director: Jack Brisbin
  - e. Newsletter Editor: Amu Cantu
  - f. Webmaster: Krishna Rao
  - g. Online Coordinator: Jeff Kopmanis
3. Westland Library
  - a. Would like some kind of star-party; good venue with reasonable lighting
  - b. Dates are open to any summer month, probably July or August
  - c. Covid/health safety protocol
4. Events
  - a. May 5: Amy running event in Jackson Rd east of Zeeb; Brian doing EAA; in newsletter
  - b. May 16: Total Lunar Eclipse (Blood Moon) at Scherzer Observatory (EMU)
  - c. June 6: Emerson Library (Monday) Astro preso Monday Morning
    - i. 65 middle schoolers
    - ii. 3 hours before lunchtime
    - iii. 3 sections: Brian Preso, Solar viewing, Optics bench
  - d. July - No camp Burt-Shirley
  - e. Belleville HS event - Adrian
  - f. MMSS (Mich. Math & Science Scholars) Aug 2 (Aug 3 rain date)
  - g. July meeting at EMU is covered
5. Detroit Observatory now reopened with good class/meeting room facilities
6. Officer Reports:
  - a. Liz Calhoun - VP (email below)
  - b. Doug Scobel - Treasurer (email below)
  - c. Jack Brisbin - Obs. Director
    - i. Detroit Observatory pics (mechanical drive)
    - ii. Shannon: trained, but docents have replaced volunteers ("exciting and new")

- iii. McMath is good, maintenance is up to date
- d. Jeff Kopmanis - Communications
  - i. Attendance Peaks: Online: 14 In-person: 13
- e. Dave Snyder
  - i. Planetarium is now open again
    - 1. Norb will be meeting UM's next week
    - 2. May is the State Planetarium Directors' meeting
  - ii. Adrian planetarium
- f. Jim Forrester
  - i. Member (& invited guests) Nights
    - 1. Covid Safety Protocols need to be established
    - 2. Hopefully beginning in May
  - ii. Public Open House
    - 1. Covid Safety Protocols need to be established
    - 2. Needs 3-5 people to make it happen plus member scopes
    - 3. Dark moon Saturday nights
    - 4. Volunteers need to step up to help
      - a. Charlie Nielsen & John Wallbank volunteered as Open House Coordinators

**Meeting Adjourned:** 9:23pm Motion: Don Seconded: Adrian

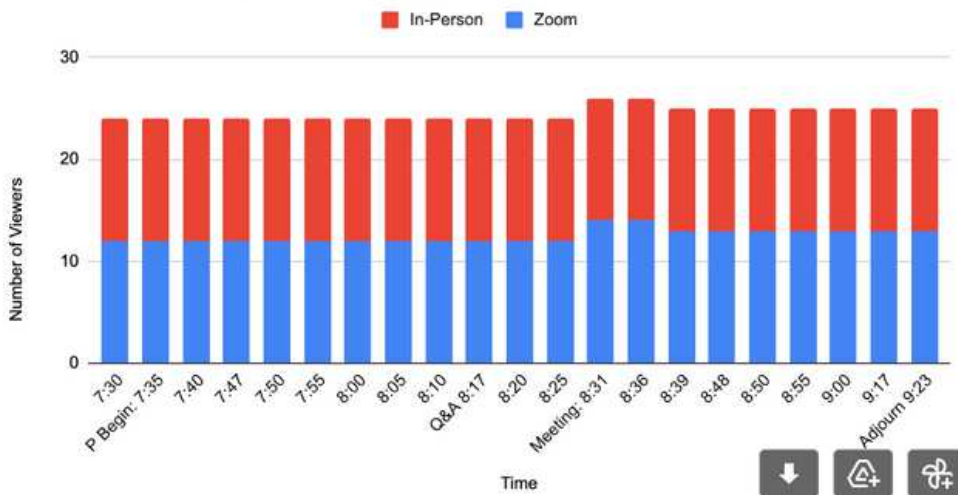
**Next Meeting:** May 20, 2022

Speaker: Professor Rudi Lindner, U/M History

Topic: "Michigan-California Axis of Astronomy"

### Meeting Attendance

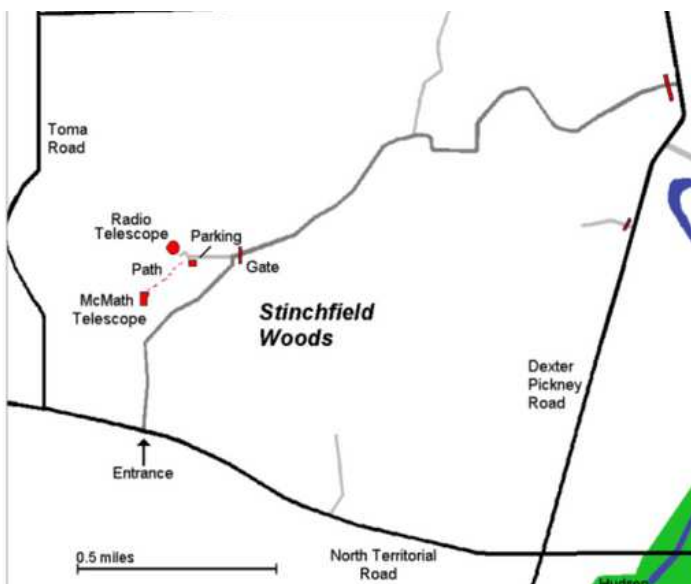
April 2022 - Adrian Bradley (Lowbrow VP)



## PLACES & TIMES

Monthly meetings of the University Lowbrow Astronomers are held the third Friday of each month at 7:30 p.m. The location is usually Angell Hall, ground floor, Room G115. Angell Hall is located on State Street on the University of Michigan Central Campus between North University and South University Streets. The building entrance nearest Room G115 is the east-facing door at the south end of Angell Hall.

Peach Mountain Observatory is the home of the University of Michigan's 25-meter radio telescope and McMath 24" telescope, which is maintained and operated by the Lowbrows. The entrance is addressed at 10280 North Territorial Road, Dexter MI, which is 1.1 miles west of Dexter-Pinckney Rd. A maize and blue sign marks the gate. Follow the gravel road to the top of the hill to a parking area south of the radiotelescope, then walk about 100 yards along the path west of the fence to reach the McMath Observatory.



## PUBLIC OPEN HOUSE / STAR PARTIES

Public Open Houses / Star Parties are generally held on the Saturdays before and after the New Moon at the Peach Mt. Observatory but are usually canceled if the forecast is for clouds or temperatures below 10 degrees F. For the most up-to-date info on the Open House / Star Party status call: (734) 975-3248 after 4 pm. Many members bring their telescope to share with the public and visitors are welcome to do the same. Mosquitoes can be numerous, so be prepared with bug repellent. Evenings can be cold so dress accordingly.

Lowbrow's Home Page  
<http://www.umich.edu/~lowbrows/>

## MEMBERSHIP

Annual dues are \$30 for individuals and families, or \$20 for full time students and seniors age 55+. If you live outside of Michigan's Lower Peninsula then dues are just \$5.00. Membership lets you access our monthly newsletter online and use the 24" McMath telescope (after some training). You can have the newsletter mailed to you with an additional \$18 annual fee to cover printing and postage. Dues can be paid by Venmo, PayPal, or by mailing a check. For details about joining the Lowbrows, contact the club treasurer at: [lowbrowdoug@gmail.com](mailto:lowbrowdoug@gmail.com)

Lowbrow members can obtain a discount on these magazine subscriptions:

**Sky & Telescope** - \$43.95/year

**Astronomy** - \$34.00/year, \$60.00/2 years or \$83.00/3 years

### Newsletter Contributions:

Members and non-members are encouraged to write about any astronomy-related topic. Contact the Newsletter Editor: Amy Cantu [cantu.amy@gmail.com](mailto:cantu.amy@gmail.com) to discuss format. Announcements, article, and images are due by the 1st day of the month as publication is the 7th.

### Telephone Numbers:

President:	Charlie Nielsen (734) 747-6585
Vice President:	Adrian Bradley (313) 354-5346
	Jim Forrester
	Brian Ottum
	Dave Snyder
Treasurer:	Doug Scobel (734) 277-7908
Observatory Director:	Jack Brisbin
Newsletter Editor:	Amy Cantu
Key-holders:	Jim Forrester
	Jack Brisbin
	Charlie Nielsen
Webmaster:	Krishna Rao
Online Coordinator:	Jeff Kopmanis

**A NOTE ON KEYS:** The Club currently has three keys to the Observatory and the North Territorial Road gate to Peach Mountain. University policy limits possession of keys to those whom they are issued. If you desire access to the property at an unscheduled time, contact one of the key-holders. Lowbrow policy is to provide as much member access as possible.

Email to all members  
[Lowbrow-members@umich.edu](mailto:Lowbrow-members@umich.edu)





# University Lowbrow Astronomers



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